RESULTS OF RESEARCH

in

GREENHOUSE VEGETABLE CROPS

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Department of Horticulture
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SOIL STEAMING AND LEACHING*

I. C. Hoffman

In general, soil steaming has affected the rate of plant growth and yields during this experiment up to the fall of 1955. The difference in yield was not pronounced in the spring of 1953, except where the soil was steamed at 160°. In this case the yield was considerably increased. Leaching had no effect in the same crop. In the fall crop, 1953, both steaming and leaching the soil increased yields about 20 percent. In 1954, the spring crop was increased by steaming at 160° and 200° F. over the unsteamed check by 25 percent or more, and steaming at 160° and leaching increased yields most. In the fall of 1954, steaming at 160° and 200° increased yields close to 50 percent and leaching had less pronounced effect. The greatest increase by leaching was again in steaming at 160°.

In the spring of 1955, steaming at both temperatures, both without and with leaching, yields were much increased and were much the same. Before the fall crop, 1955, was planted, phosphate and potash were added to the soil and the checks were steamed to kill nematodes. Differences in yield were erased and all treatments yielded much the same whether leached or not.

In general, steaming at 160° F. gave best responses over non-steaming early in the experiment and leaching gave larger increases at 160° than at 200°. Later in the experiment leaching gave best yields when the soil was steamed at 200° F. Steaming at 160° F. followed by leaching, proved to be the most important practice.

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* Data from State Project 283 which is a cooperative arrangement with E. K. Alban, I. C. Hoffman and F. S. Howlett.

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MANGANESE CONTENT OF LEAVES OF PLANTS IN SOIL STEAMING EXPERIMENT

Freeman S. Howlett

Spring Crop 1955

1. The manganese content of the leaves was outstandingly higher in the plants growing in the steamed soil (160° and 200° F.) than in the unsteamed soil. This was true both at the first sampling (May 13) and at the second sampling (July 7).
2. The manganese content in the leaves of the plants in the steamed but unleached soil was much higher than in comparable plants growing in the leached soil.
3. The difference in the manganese content of the leaves between the 160° and 200° F. steaming treatments was less pronounced than had been observed in previous seasons.
4. The manganese content of the leaves adjacent to the 5th cluster increased considerably from May 13 to the end of the crop on July 7. The amount in the foliage reached 2,500 parts per million (dry weight basis) but again no visible injury was apparent.

Fall Crop 1955

1. The manganese content of the leaves at the first cluster was increased only by the 200° F. steaming of the unleached plots. In the leached plots the manganese content was about one-half that found in the plants of the unleached plots.
2. The manganese content of the tip leaves on September 6 was quite low relative to the amount in the mature leaves of the first cluster.
3. The manganese content in the leaves approximately doubled at the 5th and 7th cluster during the period from October 17, 1955 to January 1, 1956.
4. The manganese content reached at least 2,200 parts per million (dry weight basis) without visible injury.

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POTASSIUM CONTENT OF PLANTS IN THE SOIL STEAMING EXPERIMENT

Freeman S. Howlett

Spring Crop 1955

A potassium-carrying fertilizer (potassium sulfate) has been applied to the soil of this compartment ahead of the spring 1953, 1954, and 1955 crops. The peanut hull mulch was first applied ahead of the spring 1954 crop.

1. The potassium content of the leaves at the third cluster was much greater in the plants growing in the steamed soil than in the unsteamed soil.
2. The potassium content of the leaves at both the third and fifth clusters decreased greatly from May 13 to July 7.
3. The decrease in potassium resulted in a pronounced deficiency in the leaves of plants in all treatments by July 7.

Fall Crop 1955

Potassium sulfate (1,000 lbs. per acre) was applied ahead of this crop.

1. The potassium application and the steaming resulted in high potassium content of leaves.
2. There was no significant difference in potassium content of the leaves of plants in the leached and non-leached plots.

General

1. Steaming invariably resulted in an appreciable increase in the potassium content of the leaves of plants.
2. Leaching the soil had little or no effect upon the potassium content of the foliage of plants growing in steamed and unsteamed soil.
3. The plants growing in both the steamed and unsteamed soil at the end of the fall crop 1955 (January 3, 1956) had a satisfactory supply of all essential elements for which analyses were made. This included nitrogen, phosphorus, potassium, calcium, magnesium, and iron. Manganese was in considerable excess, but no visible injury was observed.

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TOMATO MULCHING MATERIALS

I. C. Hoffman

Wheat straw, strawy manure, clover chaff, peanut hulls and peanut hulls (spring) and wheat straw (fall) have been applied regularly to the same plots for eight crops. At the beginning of the experiment no supplementary chemical fertilizers were applied. The object of the experiment was to see what effects these mulches would have in supplying nutrient materials to maintain yields and quality of the fruit. All of the mulching materials maintained yields 10 percent or more above the no-mulch check in the spring of 1953. Since that time, the yields in the straw mulch plots have been low in all crops through the fall crop of 1955. The yields of the other treatments were high all the time, but during the fall of 1955 the plants in all of the treatments became nitrogen deficient as was shown by analysis. So, these mulching materials will not supply enough nitrogen and potassium to the soil to meet all of the crop needs indefinitely, but sometime a point will be reached where supplementary nitrogen will have to be added.

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TOTAL NITROGEN IN PLANTS GROWING IN THE MULCH EXPERIMENT

Freeman S. Howlett

Spring Crop 1955

No nitrogen had been applied other than in the mulching material since initiation of the experiment beginning with the Spring 1952 crop. Nitrogen was applied for the first time as a side dressing on April 14, 1955 (ammonium nitrate, 200 lbs. per acre).

1. At the earliest sampling date, April 14, the total nitrogen content of the plants growing in the wheat straw mulch was much lower than that in the plants receiving any other treatment. In the first cluster leaves, the total nitrogen was highest in the leaves of the following treatments: Clover chaff, peanut hulls (both crops), and peanut hulls (spring crop), and wheat straw (fall crop).
2. By May 15 the total nitrogen content of the leaves in all plots except wheat straw showed a considerable reduction. This decrease in total nitrogen continued until the end of the crop.
3. The leaves of the plants in the wheat straw plots were undoubtedly deficient in nitrogen during the period from May 15 to July 7 when the plants were removed.

Fall Crop 1955

1. The differences in the total nitrogen content of the leaves were insignificant.
2. The total nitrogen content, as expected, decreased from October 18, 1955, to January 3, 1956, but was above the deficiency level until the end of the crop.

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POTASSIUM IN THE PLANTS GROWING IN THE MULCH EXPERIMENT

Freeman S. Howlett

Spring Crop 1955

Apart from potassium occurring in the plant residues applied as mulches or in the manure, no potassium had been added to the soil since initiation of the experiment beginning with the spring crop of 1952.

1. The potassium content of the leaves on April 14 was highest in the strawy manure plots followed in descending order by clover chaff, with wheat straw, peanut hulls (alone and with wheat straw) occupying an intermediate position. The leaves of the plants in the no-mulch plots were lowest in potassium and at the border line of deficiency.
2. The potassium content of the leaves in all plots fell rapidly until the end of the crop (July 7). By May 15 only the leaves in the strawy manure and clover chaff plots were distinctly above the critical range (deficiency). By July 7 the potassium content of the leaves of all plots showed a deficiency. The lowest values were in the no-mulch plots while the leaves of the plots in the clover chaff plots had the highest content.

Fall Crop 1955

Peanut hulls mulch and potassium (potassium sulfate 500 lbs. per acre) were applied to the no-mulch plots ahead of this crop.

1. Again the leaves of the plants in strawy manure and the clover chaff plots showed the highest potassium content at the first sampling date (October 18). The plants in the peanut hulls (both crops) and peanut hulls (spring) and wheat straw (fall) were intermediate in content, while in wheat straw the content of potassium was lowest and indicated a deficiency. The peanut hulls-wheat straw combination was on the border line.
2. By the end of the crop, only the plants in the strawy manure, clover chaff, and no-mulch (to which mulch and potassium had been added) had sufficient potassium.

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TOMATO BREEDING

I. C. Hoffman

Tomato breeding for increased yields, better quality, good color, and to retain disease resistance, were the objectives of this work. Several F_1 hybrids and many selections of red and pink sorts have been made and tested. Whole families have been discarded as unsuitable. Others gave considerable promise. The lines were narrowed down last year to 24 pink and 24 red selections for testing in the fall of 1955. Out of this number 5 pink and 6 red selections proved to be outstanding and will be tested further in 1956, spring and fall.

The pink selections were:

*	Globe A-1-5	9.7 lb.
	WR3-1-1-1	8.0 "
	WR3-1-1-2	8.9 "
	WR3-2-5	7.2 "
	H3C1-2-5	8.6 "
	WR3-1	7.7 "

The red selections were:

	H3C1-1-2	7.1 lb.
	H3C1-1-4	7.8 "
*	H3C1-1-5	8.8 "
*	H3C1-1-6	8.6 "
*	H3C1-1-8	7.1 "
	H3C1-2-6	8.0 "

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SOME GREENHOUSE TOMATO DEFECTS WHICH DISCOURAGE CONSUMER ACCEPTANNCE

E. K. Alban and M. E. Cravens

Greenhouse tomatoes compete with outdoor grown tomatoes in the late spring and early fall, with green-wrap tube tomatoes in the fall and spring, and more recently with vine-ripened staked tomatoes from the South in the spring months. Comparative quality studies of these various tomatoes offered at the retail level has revealed that the greenhouse tomato is usually a good buy for the quality-conscious consumer. These studies, however, also reveal that while there has been a fairly steady improvement in the quality of competitive tomatoes, there has been no appreciable change in the quality of greenhouse tomatoes. This is a rather alarming situation and one which should cause every greenhouse grower to consider his cultural practices and the post-harvesting handling of his product. As a starting point, it might be worthwhile to discuss one of the major problems which has been noted with greenhouse tomatoes in the retail store display.

Maturity: Greenhouse tomatoes were purchased which ranged from water-filled purple skins to off-color baseballs. Fortunately most of the fruit purchased was of a more desirable quality but many greenhouse tomato sales can be discouraged by a few bad tomatoes. Proper harvesting for a given market, precooling to firm the tomato, and proper instruction and follow-up education of the wholesaler and retailer could aid in improving the quality of greenhouse tomatoes. Vine-ripened,full colored fruit should be held at about 50° to 55° F. to maintain firmness and tomato flavor. Less mature fruit must be held at a higher temperature, 65° to 70° F. to allow maximum color and flavor to develop and then can be displayed at a slightly cooler temperature or for holding, i.e., 50° to 60° F. If tomatoes received only half the care that bananas receive in the wholesale and retail handling, there would be a major improvement in the quality of tomatoes purchased by the consumer. Growers and buyers must learn to better appreciate the importance of maturity at harvest and holding temperatures in relation to a quality tomatofor the consumer.

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TOMATO MERCHANDISING

M. B. Cravens

For the spring tomato crop in 1955, sales were observed in twelve retail stores in Columbus. In four of these stores no attempt was made to influence sales.

In each of the other eight stores one of three types of packages were displayed in addition to the regular bulk display and the size of display was increased by about 50 percent. Results: In the stores carrying experimental packaging and with larger displays, sales for the four weeks of the experiment were 57 percent above those at the start of the period. In the stores where no packaging was added and where the display size remained the same, sales remained at the original levels during the four weeks of the study.

The type of packaging was less important than the presence of some sort of package on the display counter. Sales from displays where packages were added to the bulk offerings were about one-fifth greater than where bulk tomatoes were displayed alone.

A major problem is the education of retailers on how they can increase greenhouse tomato sales and why it will pay them to do so.

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Bibb Lettuce Culture

I. C. Hoffman

Work on this project has been directed to three phases, (a) selection for improved strains, (b) distance of planting, and (c) different temperature effects. Fall and winter crops have been raised, and a spring crop has just been planted.

Selection: Individual plant selection has already isolated several uniform lines which show considerable promise. They are dark green with broad leaves and make large full heads. The quality seems to be better than average.

Distance of Planting: The plants were spaced 6" x 6", 7" x 7" and 8" x 8" in separate blocks. The closest spacing covered the ground quicker than the others. This kept the plants from spreading and tended to promote earlier heading by keeping the leaves closer together. These heads were somewhat smaller, but the larger number of plants per unit area made greater total weight than at the wider spacings. At the wider spacings, however, the heads were larger which tended to delay harvesting a few days so they could mature. Otherwise, the quality was practically the same.

Planting at 8" x 8" seemed to be too wide for fall and winter as much of the bed surface was uncovered. It seemed that 7" x 7" is much better for winter as there were more plants than when planted 8" x 8" and the ground was covered when the crop was mature. The heads were about the same size at the 7" x 7" and 8" x 8" spacings.

Temperature: Plants were grown at night temperatures of 53° F., 48° F. and 43° F. to see what effects different temperatures had on the growth and quality of the lettuce. Without artificial cooling it was impossible to raise the fall crop uniformly at these temperatures. In the winter the temperatures were held closely at these ranges and the effects were more pronounced. At 53° F. the plants grew most rapidly. They were good color, large, succulent and had excellent flavor. They reached cutting size

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in eighty-five days from planting. Those grown at 48° F. were delayed nearly a week longer before they were ready to harvest. The color and quality was much like those raised at 53° F. They had somewhat more purple pigment developed than those plants raised at 53° F. The crop held at 43° F. took still longer to develop. They were two weeks or more later than the plants at 53° F. The plants were also quite dark in color, but had much more purple color than either of the other two plantings. They also developed bad flavors and the leaves were harsh and became granular when eaten. This range of temperature seems too low for Bibb lettuce. Plant analysis showed that these plants were nitrogen deficient.

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